

**US7948208B2 POWER SOURCE, CHARGING SYSTEM, AND
INDUCTIVE RECEIVER FOR MOBILE DEVICES**

This chart refers to versions of the WPC Standard, including exemplary versions 1.1.2 and 1.2.4, as part of its evidence of infringement. However, this should not be interpreted to limit Plaintiff's infringement contentions to products complying with any particular version of the WPC standard (or products complying with the standard at all).

1. A charger system for use with a mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, for charging and/or powering the device and/or battery inductively, comprising:

As detailed below by representative products, the 208 Accused Products fit the description in this introductory part of the claim as each is a charger as specified by this introductory part of the claim.

Wireless chargers

The 930 Stand, 5200 Duo Pad, 5400 Duo Pad, 6300 Trio Pad, and 5300 Car Phone Mount chargers are representative of the Samsung wireless charger pads/stands that are 208 Accused Products, as with their multiple coils they can wirelessly charge various mobile devices.

The 930 Stand can wirelessly charge various mobile devices.

<https://www.tigerdirect.com/applications/SearchTools/item-details.asp?EdpNo=2423193>

Samsung EP-NG930 Wireless Charger- EP-NG930TWUGUS Product Details

Samsung EP-NG930 Wireless Charger

Experience a modern way of charging with the Samsung EP-NG930 Wireless Charger. It is compatible with Samsung Galaxy Note5, Galaxy S6 edge+, S7, S7 edge & Qi-enabled device. It uses Samsung's Fast Charge technology to charge the device placed over it faster when used with the included Fast Charge wall charger. It eliminates the hassle of meshed charger cables to charge your devices. Designed to use your device while charging, it allows navigating through music album, playing videos and answering calls without any interruption. So, purchase the Samsung EP-NG930 Wireless Charger today!



Features:

- Wireless charging stand
- Works with Samsung Galaxy Note5, Galaxy S6 edge+, S7, S7 edge & Qi-enabled device
- Uses Samsung's Fast Charge technology to charge faster
- Allows uninterrupted usage of phone during charging

Product Features



About This Product

Take your wireless charging experience to the next level with the Fast Charge Wireless Charging Stand. The new wireless charging stand allows you to charge your compatible Galaxy device up to 1.4x faster than standard wireless charging transmitters*. Using Samsung's Fast Charge technology, the stand can transfer a faster charge to the device when used with the included Fast Charge wall charger. The Fast Charge Wireless Charging Stand is closing the gap in speed between wireless and wired charging! The stand is also backwards compatible for any Qi-enabled device so you can charge those devices wirelessly at standard speeds.



Compatibility

The wireless Fast Charge feature is compatible with Galaxy Note5, Galaxy S6 edge+ and later models of the Galaxy Note and Galaxy S series. Wireless Fast Charge is not compatible with Galaxy S6, Galaxy S6 edge or Galaxy S6 active. Those devices will charge at regular speed. Universal wireless charging support for all Qi-enabled devices. Charging your device wirelessly may require the addition of a wireless charging cover (sold separately).



Wireless charging convenience

Say goodbye to tangled wires and lost charging cables. The Samsung Wireless Charging Stand utilizes Qi Inductive Charging Technology that eliminates the need to fumble with charging cables each time you want to charge your device. Perfect for at home or the office, the dedicated charging stand is always at the ready, providing wireless power whenever you set your device on the stand. The stand was designed to allow you to still use your device while charging, propping it up so you can navigate music, review notifications and answer calls without having to interrupt charging.

The 5200 Duo Pad can wirelessly charge various mobile devices.

<https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-charger-duo-pad-black-ep-p5200tbegus/>



Qi certified

The Wireless Charger Duo Pad is Qi certified meaning any Qi compatible products can charge on it, including the Samsung Galaxy S10, Galaxy Note9, Apple iPhone 8, iPhone X, and Google Pixel 3.

The 5400 Duo Pad can wirelessly charge various mobile devices.

<https://www.samsung.com/us/mobile/mobile-accessories/phones/15w-wireless-charger-duo-cable-dark-gray-ep-p5400cbegus/>

One charger, two devices

Simultaneously power up your favorite pair of devices to enjoy together — whether that's your phone and Galaxy Watch or your Galaxy Watch and earbuds.

*The secondary part of this charger cannot charge a mobile phone and is only compatible with all Galaxy Buds and Galaxy Watch Active 1 and later watch models.



The 6300 Trio Pad can wirelessly charge various mobile devices.

https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-charger-pad-trio-white-ep-p6300twegus/?AID=11497444&PID=100357191&SID=oc5A05L8E%2FcFrofF6SHThI8f8ZnfPNw%2BZwF9PQrmDBeIEeYcE9zsc4Yit4FMR1Nx&CID=afl-ecom-cjn-cha-092118-54828&cjevent=ef703a2ec58011ec8256006e0a1c0e11&utm_source=Microsoft+Shopping+%28Bing+Rebates%2C+Coupons%2C+etc.%29&utm_medium=affiliate&utm_campaign=11497444&utm_content=100357191&cjdata=MXxOfDB8WXww#overview

The incredible 3-in-1 charger

With room to hold three devices at once — a smartwatch and two phones, or a smartwatch, earbuds, and phone — you can power up your ecosystem all at once. So when you're done for the day, just put your devices down in one place to be ready for tomorrow.



Compatible Models

Fast Charge compatible with Galaxy Note20, Note20 ultra, S20, S20+, S20 ultra, Z Fold2, Z Flip, Note 10+, Note 10, S10e, S10, S10+, S10 5G, Note9, S9, S9+, Note8, S8, S8+, S7, S7 Edge, Note 5, S6 Edge+ & Apple iPhone 11 pro, 11, SE, XS Max, XS, XR, 8, 8 Plus / Qi compatible with Galaxy S6, S6 Edge and Qi certified devices (Galaxy Buds live, Buds+) / Galaxy Watch3, Watch Active2, Watch Active

The 5300 Car Phone Mount charger can wirelessly charge various mobile devices.

<https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-car-charger-black-ep-h5300cbegus/>

Wireless Car Charger, Black

BENEFITS SPECS REVIEWS SUPPORT



Great for most types of mobile phones that support wireless charging - even foldables!

The Wireless Car Charger holds mobiles of various sizes, even mobiles covered in up to 3mm thick cases. The Wireless Car Charger is compatible with both Android and iOS devices that support wireless charging. So just place your phone in and let it charge!

*Adapter not included.

**USB-C to USB-A cable included.

***Based on internal testing. Charging tests were conducted with Samsung cases only.

****Charge time may vary depending on charging conditions, case material, device type and other factors.

*****Image simulated for illustrative purposes only.

The 3300 Wireless Charger Battery is representative of the Samsung wireless charger batteries that are 208 Accused Products, as with its multiple coils it can wirelessly charge various mobile devices including smartphones, earbud cases, and watches.

<https://www.samsung.com/us/mobile/mobile-accessories/phones/25w-wireless-portable-battery--silver-eb-u3300xjegus/>



a base unit having a surface, and comprising a plurality of primary coils arranged behind and parallel to the surface, wherein each of the primary coils is positioned within the base unit, and

The 208 Accused Products meet this part of the 208 claim 1 as they each comprise a base unit with a surface for wireless charging (see above pictures), with multiple primary coils arranged behind and parallel to the surface for wireless charging, and with associated switching circuits (as shown below with respect to the next part of claim 1).

Wireless chargers

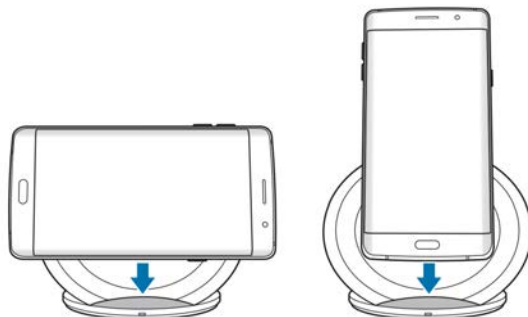
The 930 Stand, 5200 Duo Pad, 5400 Duo Pad, 6300 Trio Pad, and 5300 Car Phone Mount chargers and the 3300 Wireless Charger Battery are representative of how the Samsung wireless charger pads/stands and wireless charger batteries satisfy this part of the claim. They each have a base unit with a surface for wireless charging (their front surface; pictures shown above), with multiple coils arranged behind and parallel to the surface for wireless charging (as shown below), and with associated switching circuits (shown with respect to the next part of claim 1).

The 930 Stand includes two charging coils to wirelessly charge a smartphone in either a horizontal or vertical orientation.

<https://content.syndigo.com/asset/31e64329-99e7-40b7-ad56-5cbae62fcfee/original.pdf>

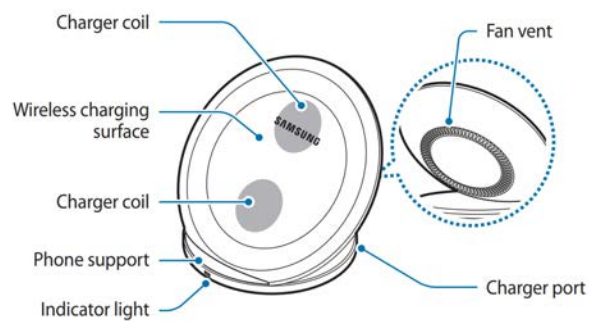
Using the wireless charger

- 2 Place a supported mobile device on the phone support.
Check the charging icon displayed on the mobile device's screen for the charging status.

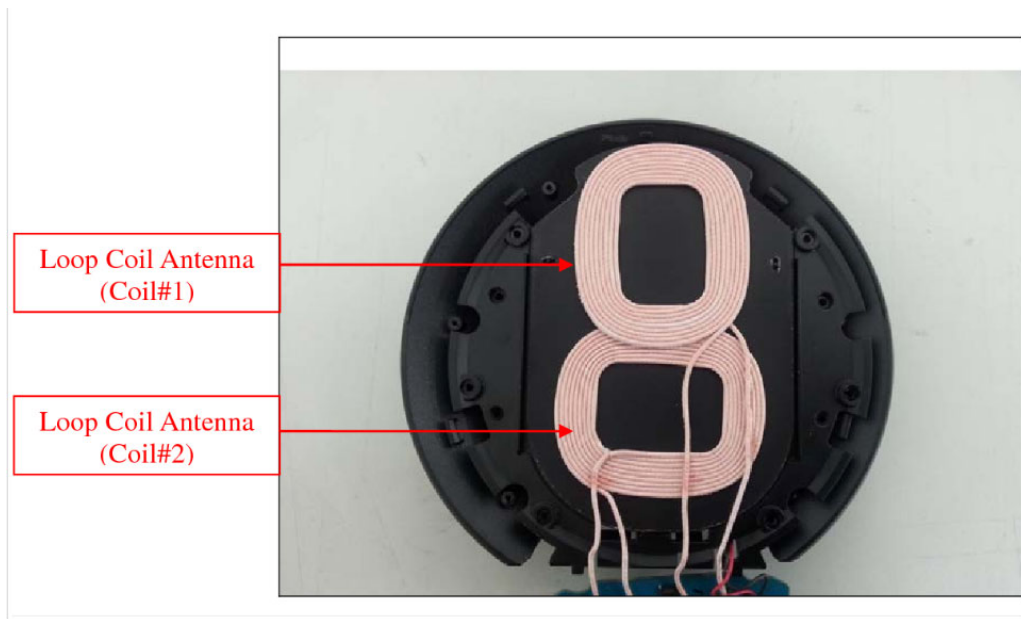


Getting started

Device layout



<https://fccid.io/A3LEPNG930/Internal-Photos/Internal-Photos-2909922>



The 5200 Duo Pad is a dual location wireless charger system that allows simultaneous charging of two smartphones (one of the left and one on the right) or a smartphone (on the left) and a Galaxy watch or earbud case (on the right).

<https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-charger-duo-pad-black-ep-p5200tbegus/>

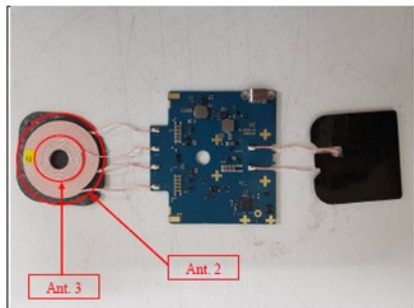


The 5200 Duo includes three charging coils (identified as antennas [Ant. 1-3] in the images below), of which the two on the product right-side (Ant. 2 and 3) are concentric (for charging a watch [Ant. 3] or another smartphone or earbud case [Ant. 2]) (Ant. 2 and 3 are shown on the left-side of the FCC pictures below, which show the interior of the product and have inverted the coil sides of the product). Antenna 1 on the product left-side (right-side of the FCC pictures) is for charging of a smartphone at up to Samsung Wireless Fast Charge 2.0 speeds.

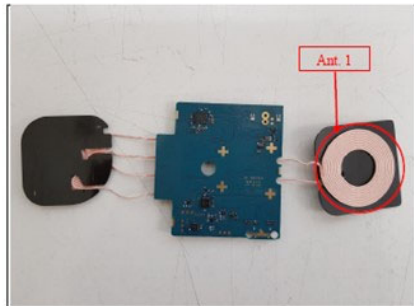
The following FCC pictures show the three charging coils in the 5200 Duo Pad (Ant. 1-3) (with the product right and left sides reversed as described above).

<https://fcc.report/FCC-ID/A3LEPP5200/4144771>

SGS
Top view of PCB



Bottom view of PCB



The following is a Samsung webpage describing the 5200 Duo Pad.

<https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-charger-Duo-Pad-pad-black-ep-p5200tbegus/>



Charge a phone and a smartwatch

The Wireless Charger Duo Pad can charge your Samsung smartwatch too. Gear S3, Gear Sport, and Galaxy Watch can charge in the same location as your phone by simply placing your watch on the charging pad.

Charge two phones

Charge up to two smartphones by simply setting them down. Advanced Qi wireless charging technology enables you to charge your device without plugging in a cable.²



The following is a Samsung Quick Start Guide describing the 5200 Duo Pad.

<https://fcc.report/FCC-ID/A3LEPP5200/4144766.pdf>

**QUICK
START
GUIDE**

EP-P5200
Wireless Charger Duo

English

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- Please read this guide before using the device to ensure safe and proper use.
- Images may differ in appearance from the actual product. Content is subject to change without prior notice. Visit www.samsung.com to view device information, the latest guide, and more.
- Before using the wireless charger, make sure it is compatible with your mobile device or Galaxy Watch.
- Your consumer rights are governed by the law of the country in which you purchased the product. Please contact your service provider for more information.

1

2

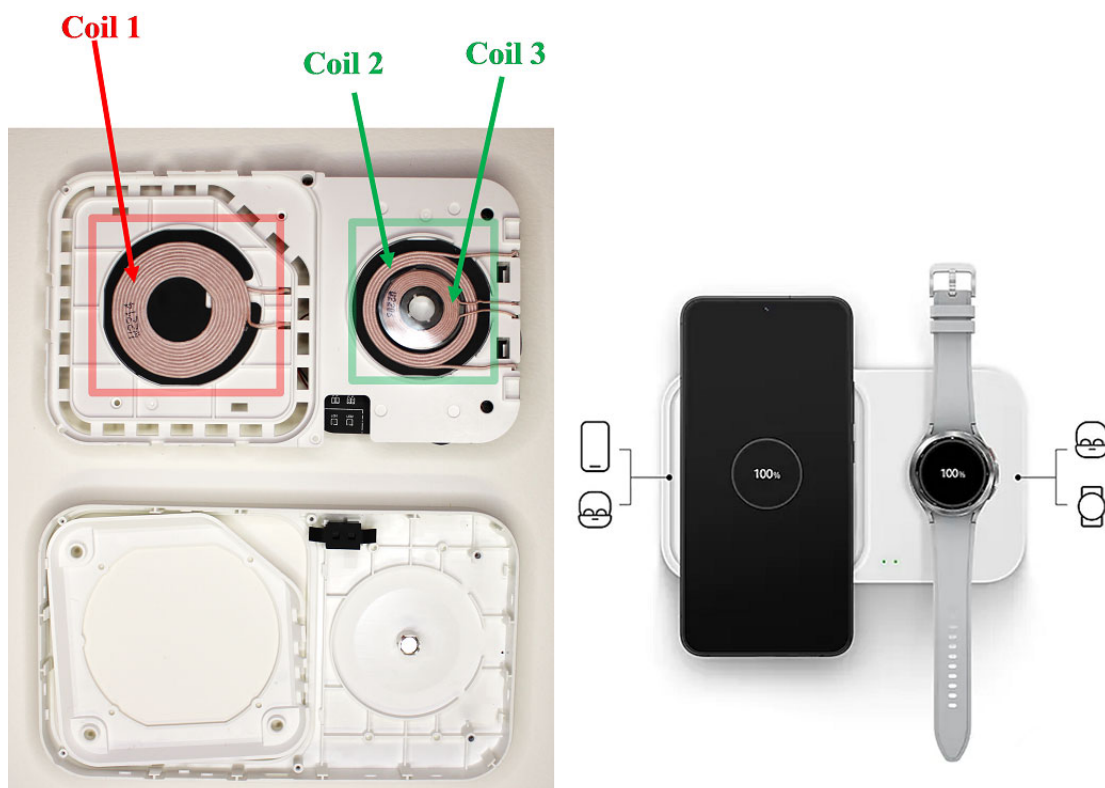
Device layout

a Wireless charging surface (left)	d Wireless charging surface (right)
b Charging coil	e Charger port (Type-C)
c Indicator light	f Fan vent

Using the wireless charger

1. Connect the charger to the wireless charger. When the charger is correctly connected to the wireless charger, the indicator light (c) flashes red, green, and orange, and then turns off.

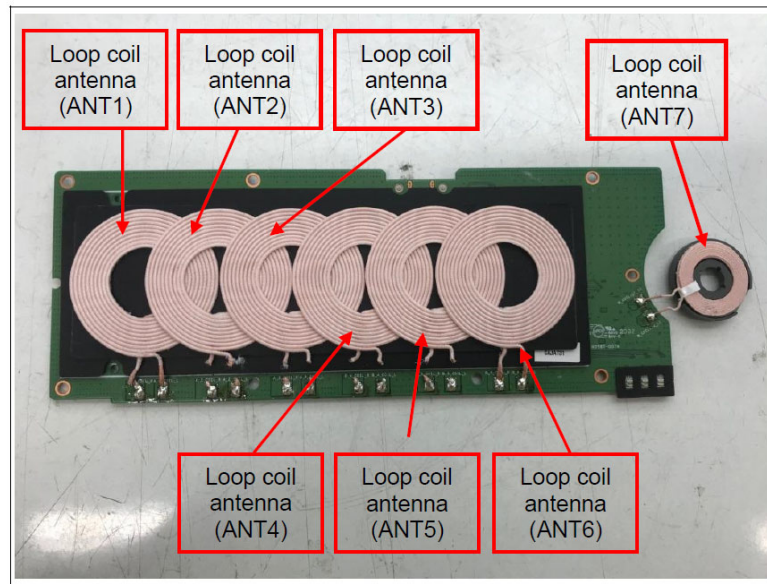
The 5400 Duo Pad includes three charging coils of which the two on the right side are concentric (inner coil for charging a watch and outer coil for charging an earbud case), as shown below. The coil on the left is for charging a smartphone or earbud case.



The 6300 Trio Pad includes seven charging coils (Ant. 1-7), of which the six on the left side of the pad are overlapping, as shown below. The coils on the left are for charging multiple smartphones and earbud cases, and the right-side smaller single coil is for charging a watch.

<https://fcc.report/FCC-ID/A3LEPP6300/4940796.pdf>

View of Antenna



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[Wireless Charger Trio, White Mobile Accessories - EP-P6300TWEGUS | Samsung US](#)

The incredible 3-in-1 charger

With room to hold three devices at once — a smartwatch and two phones, or a smartwatch, earbuds, and phone — you can power up your ecosystem all at once. So when you're done for the day, just put your devices down in one place to be ready for tomorrow.



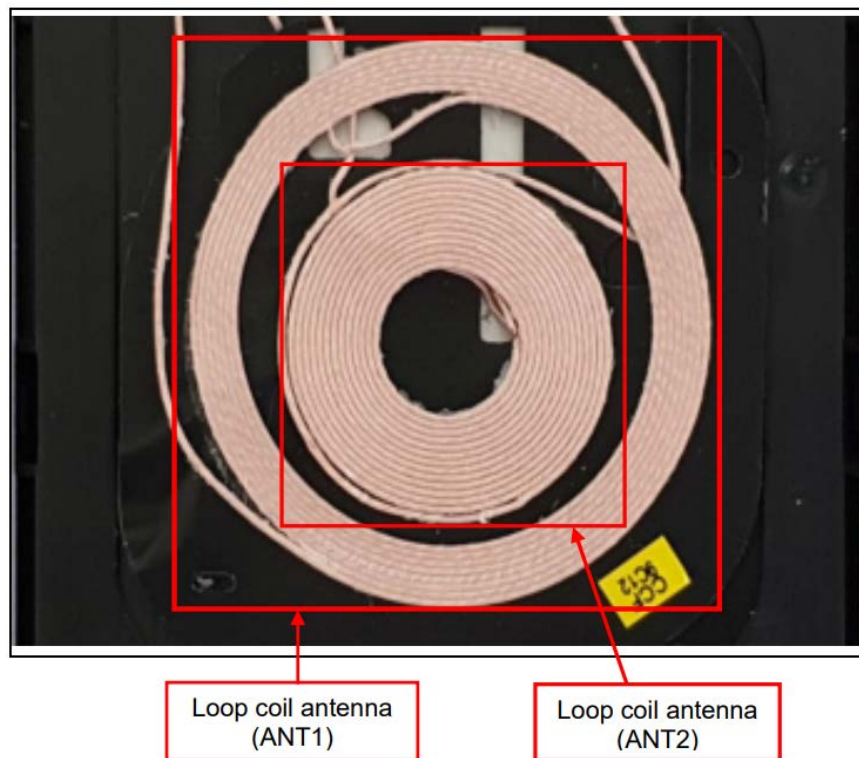
The 5300 Car Phone Mount charger includes two charging coils to wirelessly charge a smartphone in different orientations. <https://fcc.report/FCC-ID/ZCAEPH5300/5517329>

EUT Constructional Details (EUT Photos)



The 3300 Wireless Charger Battery includes two charging coils, one inside the other. The inner coil is for charging a watch; the outer coil is for charging a smartphone or an earbud case.

<https://fcc.report/FCC-ID/A3LEBU3300/4624577>



wherein each of the primary coils is associated with a switching circuit in the base unit, which switching circuit is capable of being selectively switched to activate its associated primary coil so that, when an electrical current is passed through that activated primary coil, a magnetic field is generated by that activated primary coil in a direction substantially perpendicular to the surface of the base unit, and wherein the base unit and/or switching circuit includes a capacitive or other component that decreases harmonics in that activated primary coil;

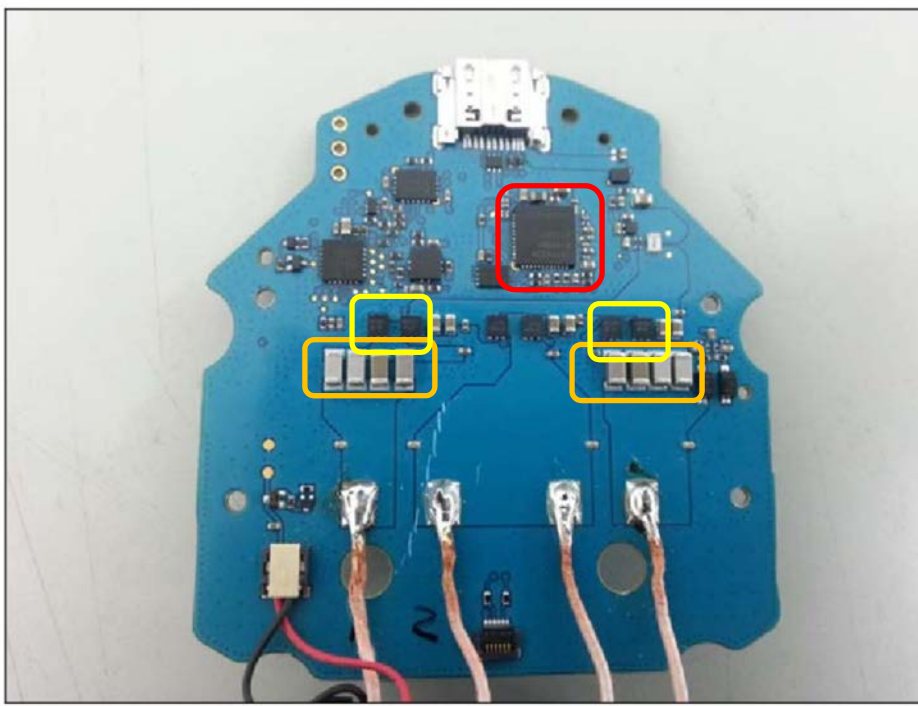
The 208 Accused Products meet this part of the claim 208 as their charging coils shown above are associated with switching circuits (including capacitors to reduce harmonics) to generate magnetic fields, as specified by this part of the claim.

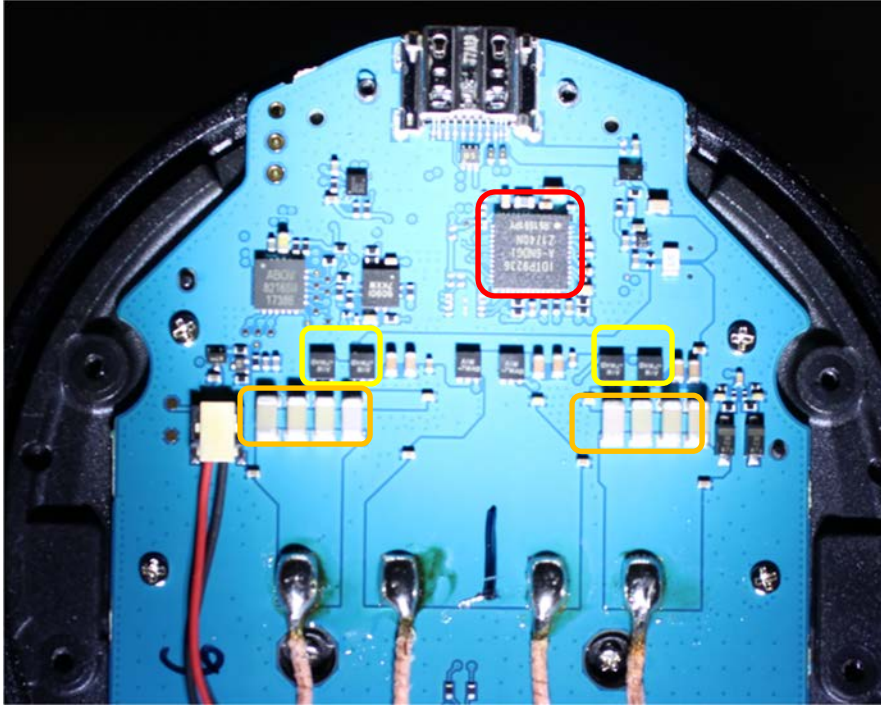
Wireless chargers

The 930 Stand, 5200 Duo Pad, 5400 Duo Pad, 6300 Trio Pad, and 5300 Car Phone Mount chargers and the 3300 Wireless Charger Battery are representative of how the Samsung wireless charger pads/stands and the Samsung wireless charger batteries satisfy this part of the claim. They each include switching circuitry, including capacitors for reducing harmonics, to drive their wireless charging coils. For example, the IDT/Renesas P9236 wireless transmitter ASICs, or other wireless charging ICs, included in the representative products comprise switching circuitry and use accompanying external capacitors as specified by this part of the claim, as shown below. Additionally, these representative products include, external to the wireless transmitter ASICs, field effect transistors (FETs) and FET drivers, as shown below.

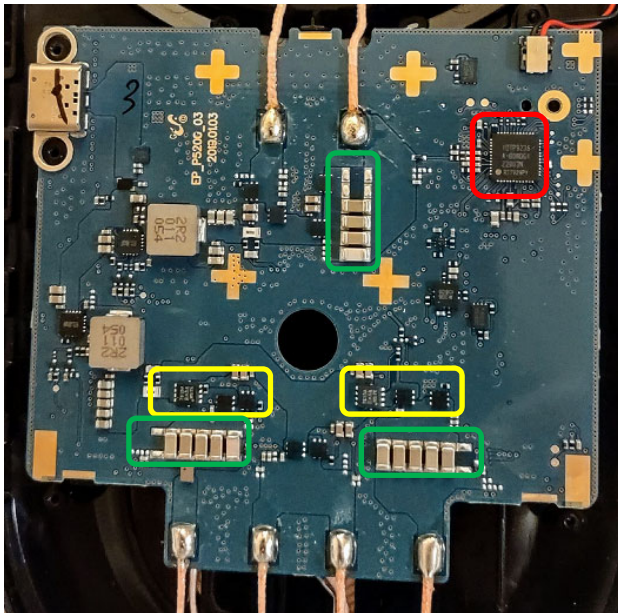
The 930 Stand includes a switching circuit associated with its two coils which includes capacitors to reduce harmonics (orange rectangles), an IDT P9236 wireless charging ASIC (red rectangles) and FETs and FET drivers (yellow rectangles), as illustrated below.

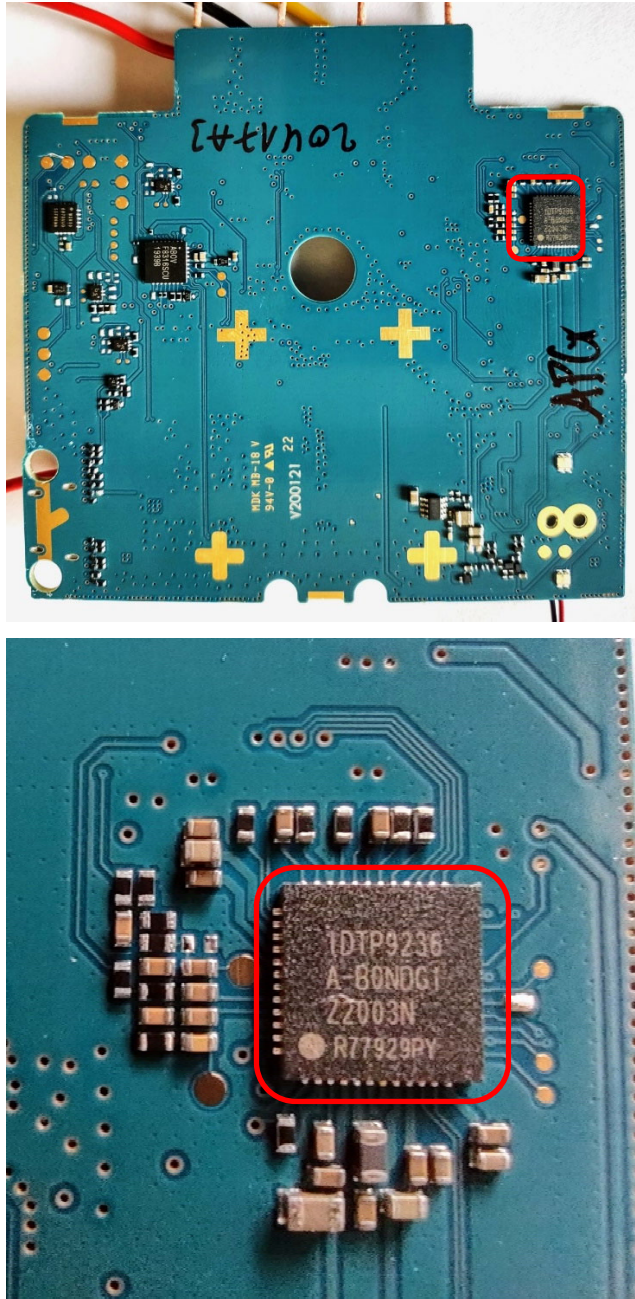
<https://fccid.io/A3LEPNG930/Internal-Photos/Internal-Photos-2909922>



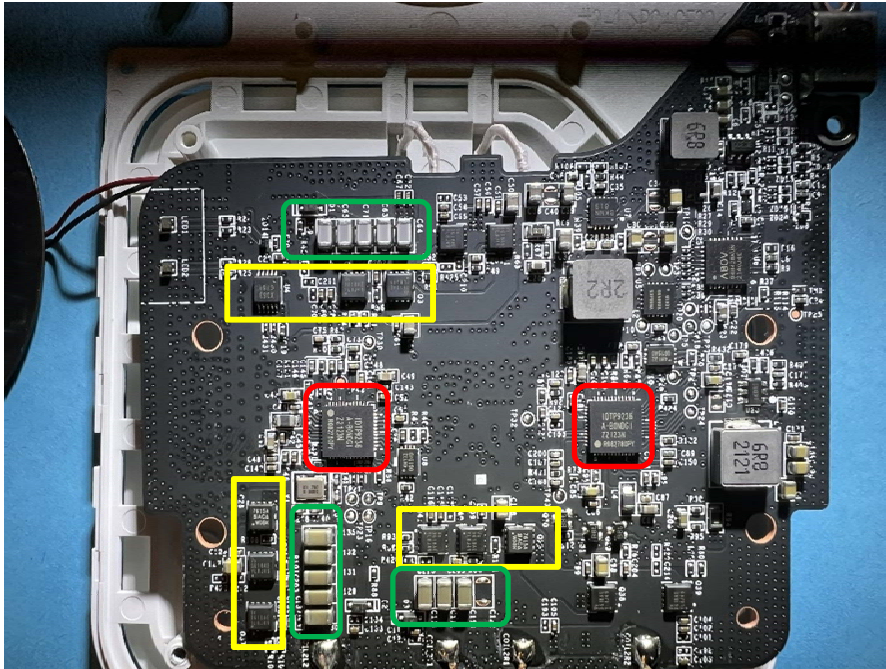


The 5200 Duo Pad includes multiple switching circuits associated with its coils which include capacitors to reduce harmonics (green rectangles), wireless charging ASICs (IDT P9236) (red rectangles) and separate FETs and FET drivers (yellow rectangles), as illustrated below.

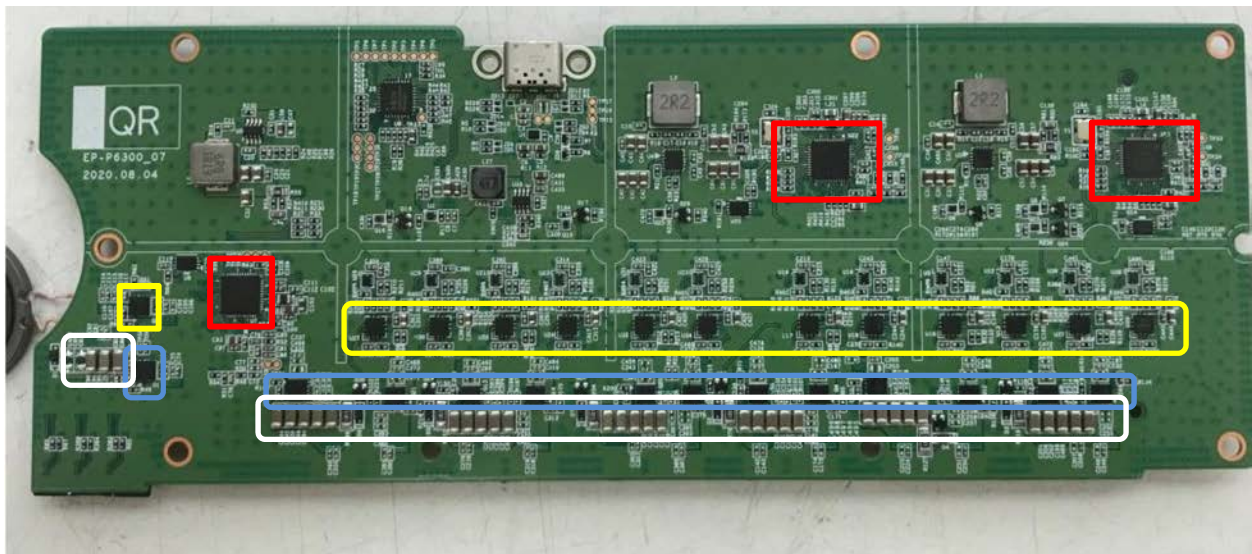




The 5400 Duo Pad includes multiple switching circuits associated with its coils which include capacitors to reduce harmonics (green rectangles), wireless charging ASICs (IDT P9236) (red rectangles), and separate FETs and FET drivers (yellow rectangles), as illustrated below.



The 6300 Trio Pad includes switching circuits associated with its coils which include capacitors to reduce harmonics (white rectangles), IDT/Renesas wireless charging ASICs (IDT P9236) (red rectangles), separate FET drivers (yellow rectangles), and separate FETs (blue rectangles), as seen below.



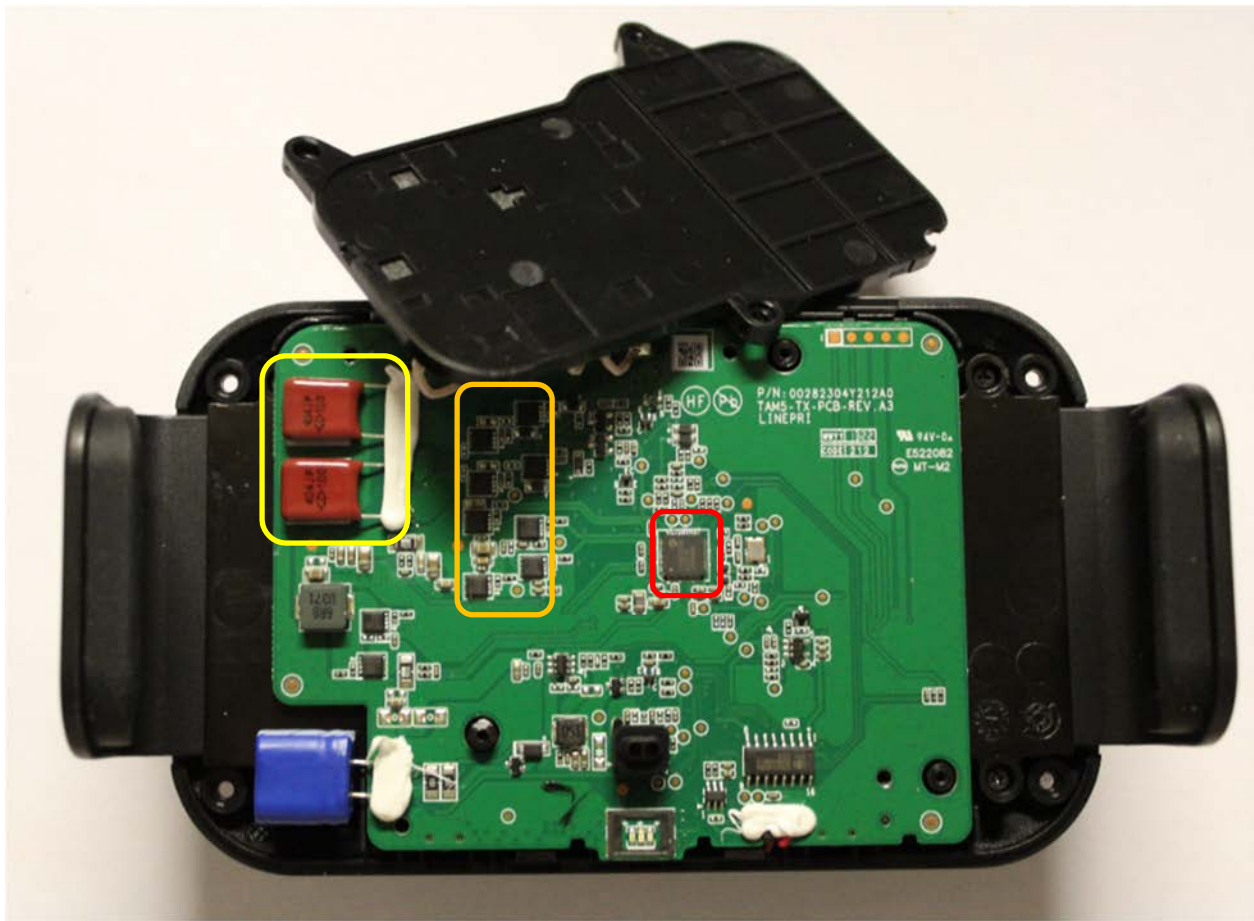
The 5300 Car Phone Mount charger includes a switching circuit associated with its two coils.
<https://fcc.report/FCC-ID/ZCAEPH5300/5517329>

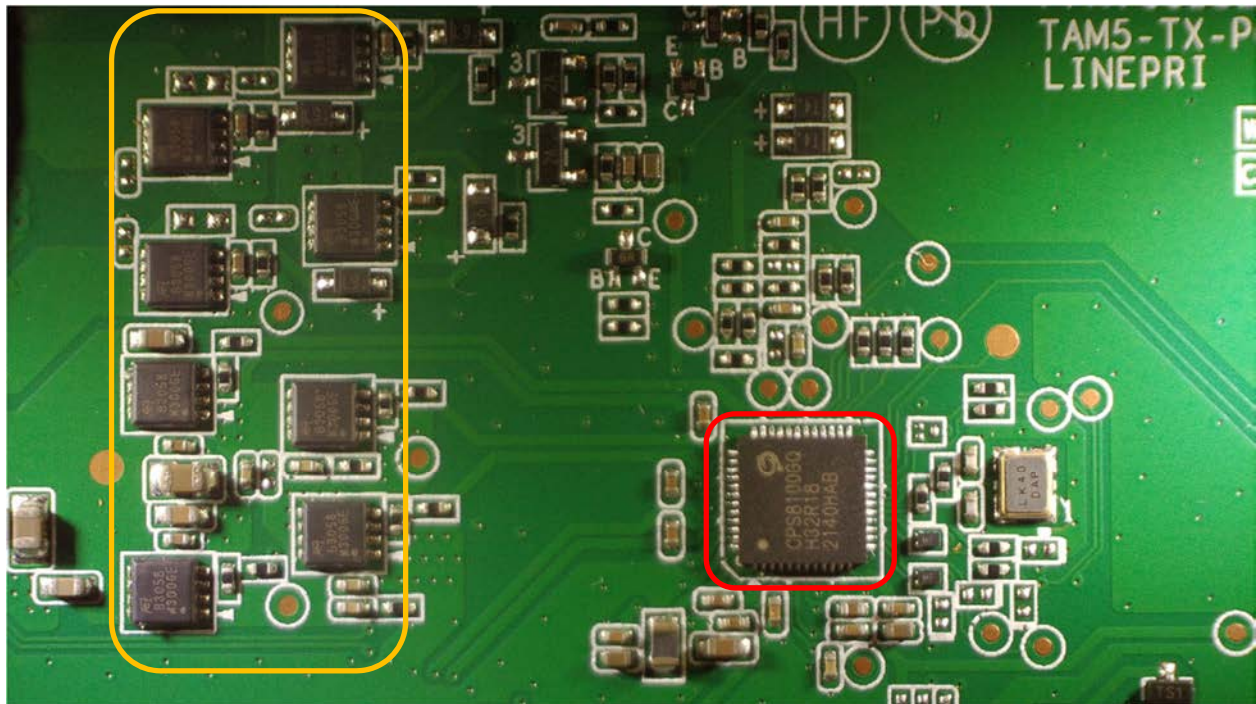
EUT Constructional Details (EUT Photos)



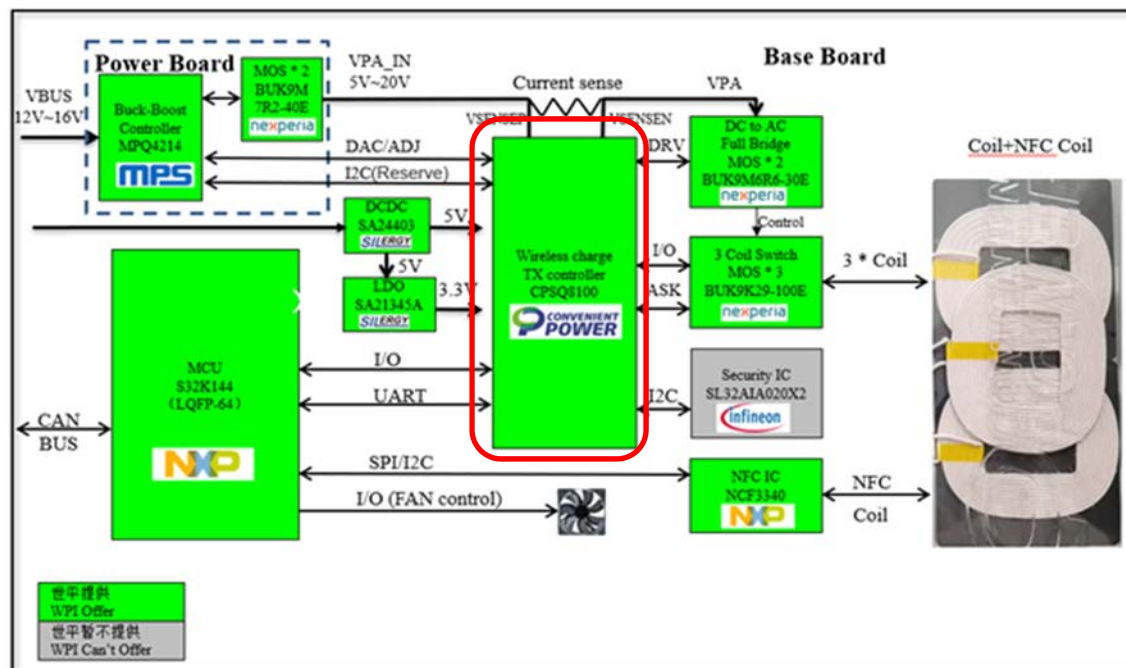
The 5300 Car Mount Charger includes a wireless charging transmitter ASIC (e.g., the CPS8100 from Convenient Power [the “CPS8100”]; red rectangles) (which has an internal FET driver) and

Mojo Mobility Inc v. Samsung Elecs. Co. Ltd., et al., No. 2:22-cv-00398 (E.D. Tex.)
Ex. 1 to Feb. 28, 2023 P.R. 3-1 Contentions: Infringement of U.S. Patent 7,948,208 by Samsung
external FETs (orange rectangles), as illustrated below. As shown below the CPS8100 operates
with harmonic reducing capacitors (yellow rectangle).





The datasheet below describes the CPS8100 ASIC:
<https://www.wpgdadatong.com/tw/blog/detail/45476>



The CPS8100 is a WPC 1.2.4 Transmitter with integrated FET drivers (Green rectangle below) and harmonic reducing capacitors (blue rectangles). The external FETs (orange rectangle) is shown in the data sheet: <https://m.eefocus.com/consumer-electronics/525801>



CPS8100 Datasheet

Highly Integrated Wireless Transmitter

Descriptions

CPS8100 is a highly efficient, Qi-compliant, magnetic inductive wireless power transmitter IC with wide input voltage range of 3.9V to 26V. It supports secure bi-directional communication with wireless power receiver (ASK/FSK), flexible communication interface ports, as well as reliable over-voltage/current/temperature protection schemes.

It includes buck converter, low dropout linear regulator, DC-DC controller, full bridge drivers, communication modulator/demodulator, foreign object detection (FOD), a multi-channel 12-bit ADC, and ARM processor core and on-chip MTP for maximize software flexibility while consuming extremely low standby power.

The CPS8100 is available in a Pb-free, small QFN 6mmx6mm, 48 pin package. This product is rated over an operating temperature range of -40 to 105°C.

Features

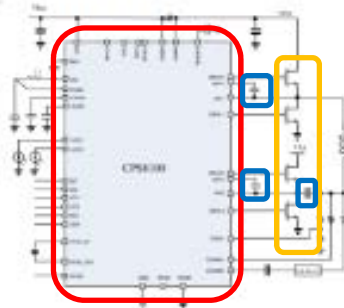
- WPC 1.2.4 compliant wireless power transmitter
- Integrated ARM core, 34KB MTP, 32KB ROM, 6KB SRAM
- Read-Protected/Write-Protected for MTP
- Support update MTP through CC or DP/DN line
- Support I2C interface
- Integrated 2x UART interface
- Flexible adaptor support: QC2.0/QC3.0/PP3.0/SCP/AFG
- Flexible output power with external MOSFET
- Integrated 3 pairs half bridge driver
- Integrated Buck or Boost controller
- Support double Rx charging application
- Integrated external crystal driver
- Low Power Mode
- Over voltage/current/temperature protection
- RoHS, Halogen-Free and Lead-Free Compliant

Applications

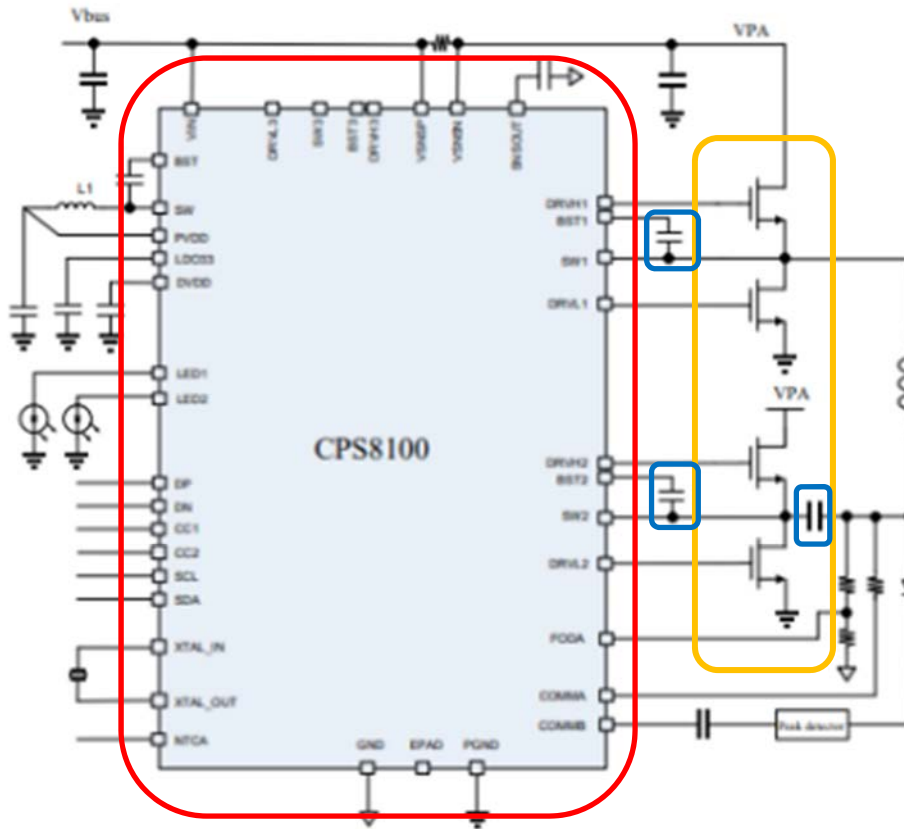
Wireless Fast Charge Transmitter for:

- Charging Pad
- Smart Phone
- MP3 Player
- Blue Tooth
- Tablets
- Accessories

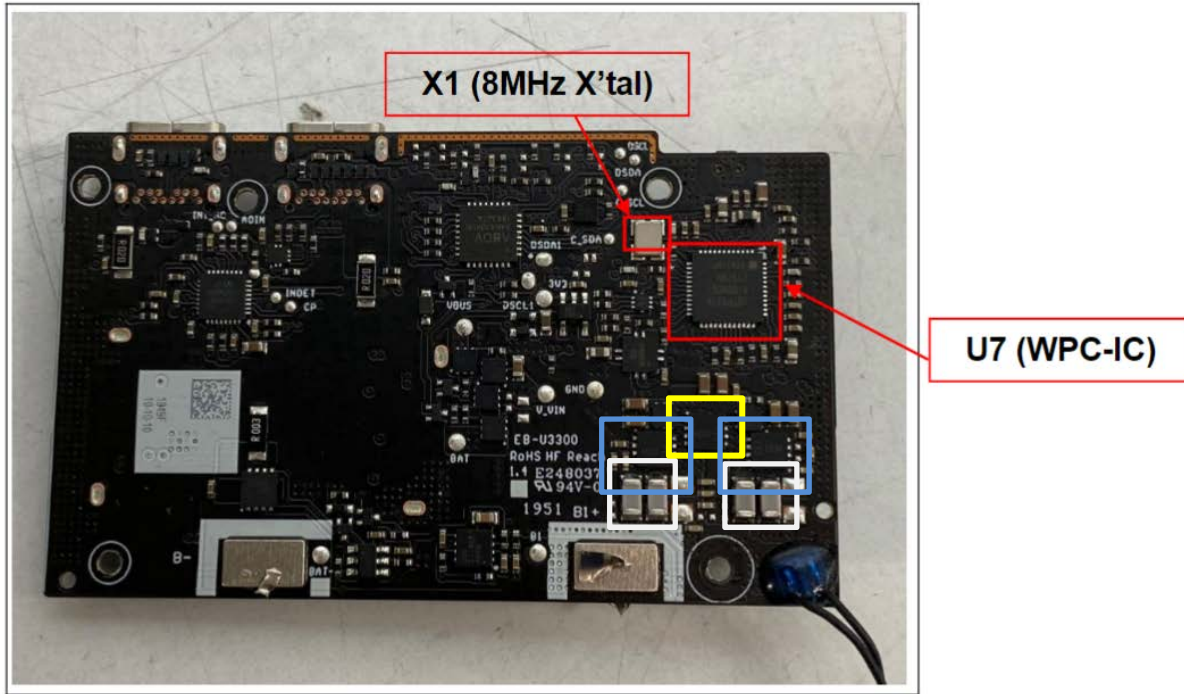
Typical Application



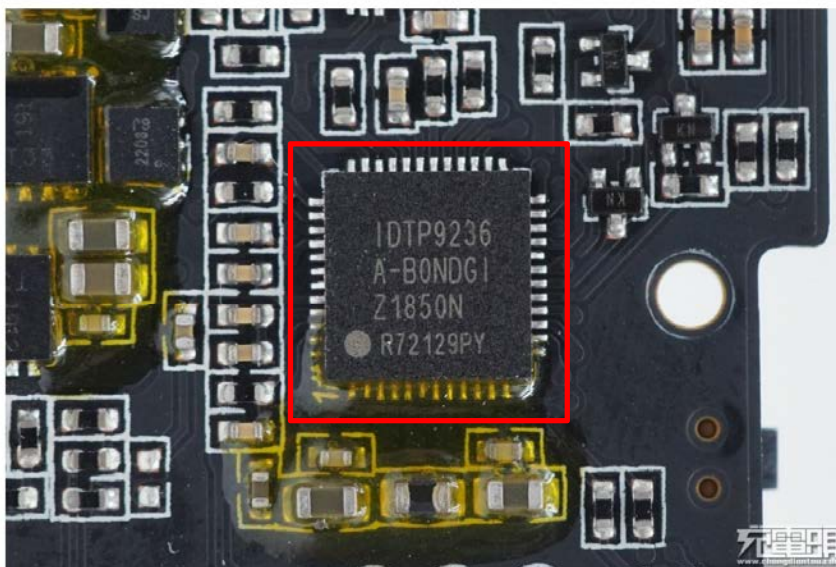
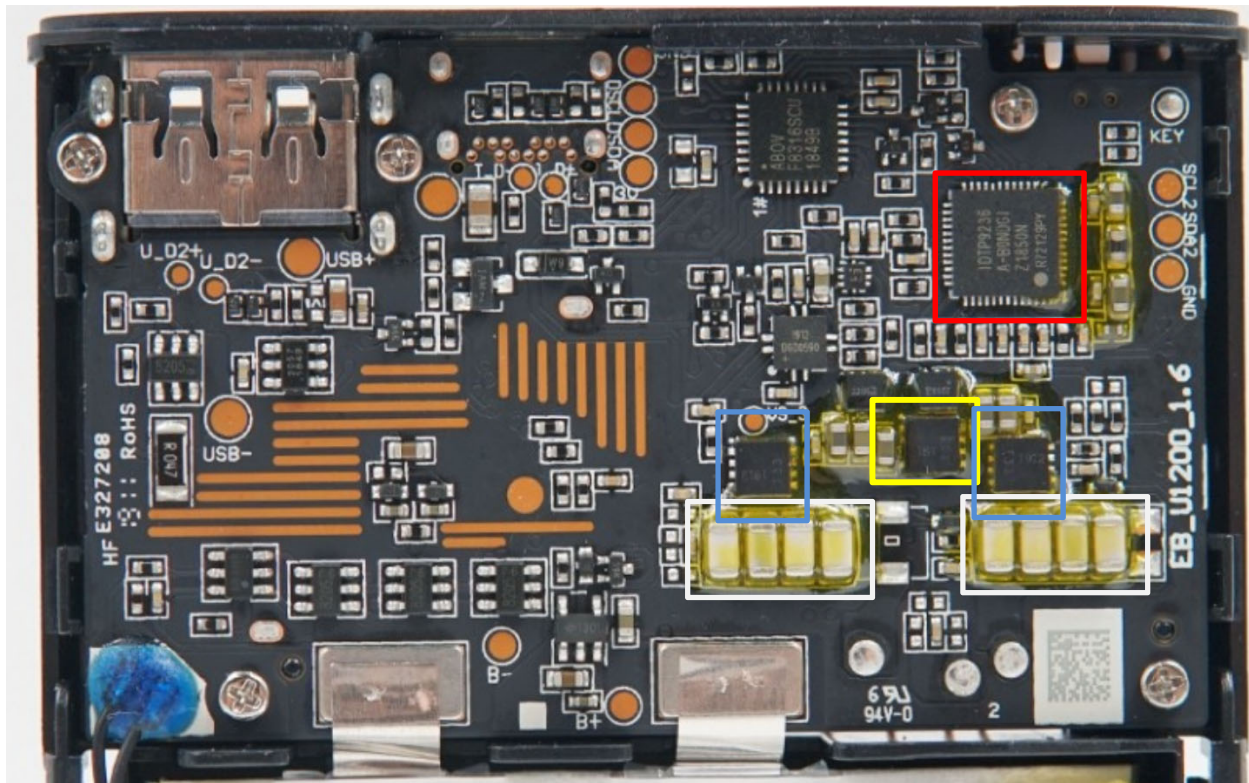
Typical Application



The 3300 Wireless Charger Battery includes switching circuits associated with its coils which include capacitors to reduce harmonics (white rectangles), a wireless charging ASIC (e.g., the IDT/Renesas IDT P9236) (red rectangle), separate FET drivers (yellow rectangles), and separate FETs (blue rectangles), as estimated below pending receiving discovery.



Mojo Mobility Inc v. Samsung Elecs. Co. Ltd., et al., No. 2:22-cv-00398 (E.D. Tex.)
 Ex. 1 to Feb. 28, 2023 P.R. 3-1 Contentions: Infringement of U.S. Patent 7,948,208 by Samsung
<https://www.chargerlab.com/samsung-wireless-charger-portable-battery-eb-u1200-teardown-review/> (predecessor 1200 Wireless Charger Battery, believed to be similar in relevant respects to the current 3300 Wireless Charger Battery)

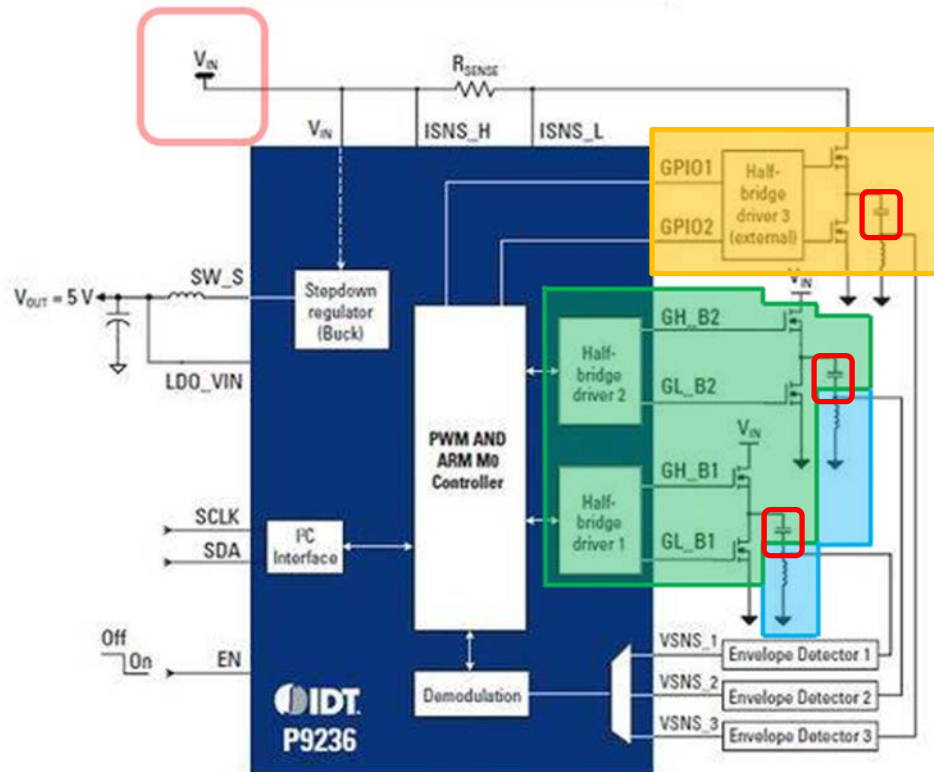


IDT IDTP9236 wireless charging controller, paired with external drive tube for wireless charging.

The IDT/Renesas P9236 transmitter ASIC (included in the above wireless chargers) includes two internal drivers for use with external FETs and capacitors (green area below) and a third external

driver can be used with additional external FETs and capacitors (orange rectangle), as shown in the datasheet below for the ASIC page below. The capacitors are shown in the red rectangles below.

https://archive.eetindia.co.in/www.eetindia.co.in/ART_8800706913_1800008_NP_7a10c6fc.HTM



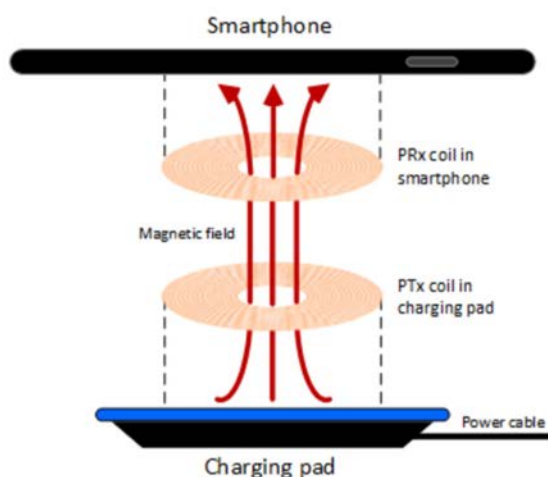
WPC Illustrations

The magnetic field generated by the charging coils in the Samsung chargers shown above is substantially perpendicular to the plane of the coils. E.g., Introduction to the Power Class 0 Specification of the WPC 1.2.4 Standard (February 2018), page 9 (“WPC 1.2.4 Standard, Introduction”).

When charging begins, the power transmitter runs an alternating electrical current through its coil(s), which generates an alternating magnetic field in accordance with Faraday's law. This magnetic field is in turn picked up by the coil inside the power receiver and transformed by a power converter back into an alternating electrical current that can be used to charge the battery.

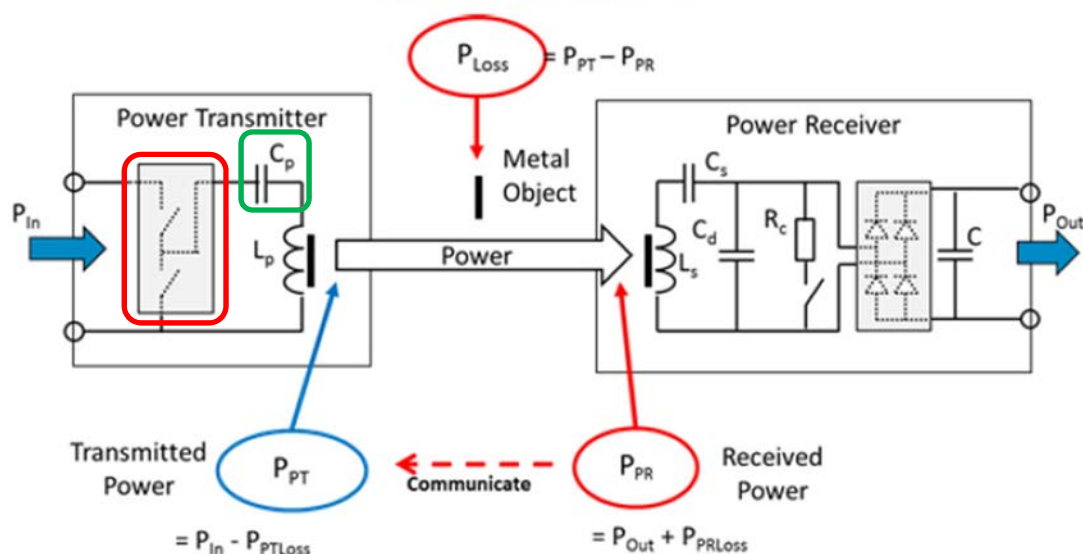
A critical feature of the magnetic field is that it can transfer through any non-metallic, non-ferrous materials, such as plastics, glass, water, wood, and air. In other words, wires and connectors are not needed between the power transmitter and power receiver.

Figure 6. Qi wireless power transfer using magnetic induction



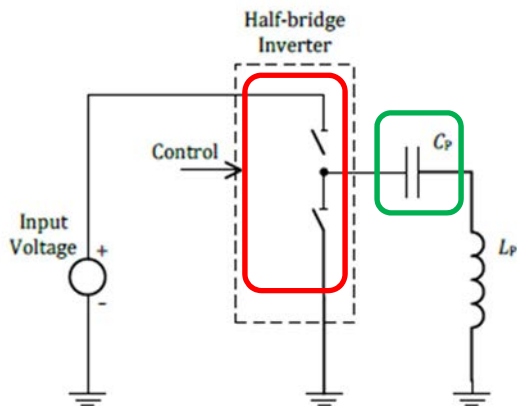
Moreover, the types of possible charger designs are specified in the WPC Standard and each contains switching circuitry (red rectangles) and capacitors (green rectangles) to reduce harmonics. This is seen in the WPC Interface Definitions. E.g., The Qi Wireless Power Transfer System Power Class 0 Specification, WPC 1.2.4 Standard, Parts 1 and 2: Interface Definitions (February 2018), page 136 (“WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions”).

Figure 47. Power losses illustrated



This is also seen in the WPC Reference Designs. E.g., The Qi Wireless Power Transfer System Power Class 0 Specification, Version 1.2.4, Part 4: Reference Designs (February 2018), page 42 (“WPC 1.2.4 Standard, Part 4, Reference Designs”).

Figure 19. Electrical diagram (outline) of Power Transmitter design A6



a power supply for passing a current through the primary coils when activated, to generate the magnetic field in a direction substantially perpendicular to the plane of the primary coils;

The 208 Accused Products meet this part of the claim 208, as they each have an external power supply (e.g., AC/DC USB adapter), powered by an AC source (e.g., AC wall power) and/or an internal power supply (powered by the external power supply) or DC source (e.g., an internal battery), to provide the needed DC voltage coupled by the switching circuits to the wireless charging coils for passing a current through the coils for inductive power transfer, as specified by this part of the claim.

Wireless chargers

The representative 930 Stand, 5200 Duo Pad, 5400 Duo Pad, 6300 Trio Pad, and 5300 Car Phone Mount chargers each has an internal power supply that is powered by an external power supply

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Ex. 1 to Feb. 28, 2023 P.R. 3-1 Contentions: Infringement of U.S. Patent 7,948,208 by Samsung
(typically a USB AC/DC power adaptor drawing AC power from a wall outlet [and from the car battery in the case of the Car Phone Mount]).

<https://content.syndigo.com/asset/31e64329-99e7-40b7-ad56-5cbae62fcfee/original.pdf>

Using the wireless charger

Charging your mobile device

Wireless charging

- 1 Connect a charger to the wireless charger.
When the charger is correctly connected to the wireless charger, the indicator light flashes blue, green, and cyan, and then turns off.



Use only Samsung-approved chargers (5 V/2 A, 5.3 V/2 A, and 9 V/1.67 A).
Unauthorised chargers may cause damage or the wireless charger may malfunction.

<https://www.samsung.com/ph/mobile-accessories/wireless-charger-Duo Pad-pad-p5200-ep-p5200twegww/>



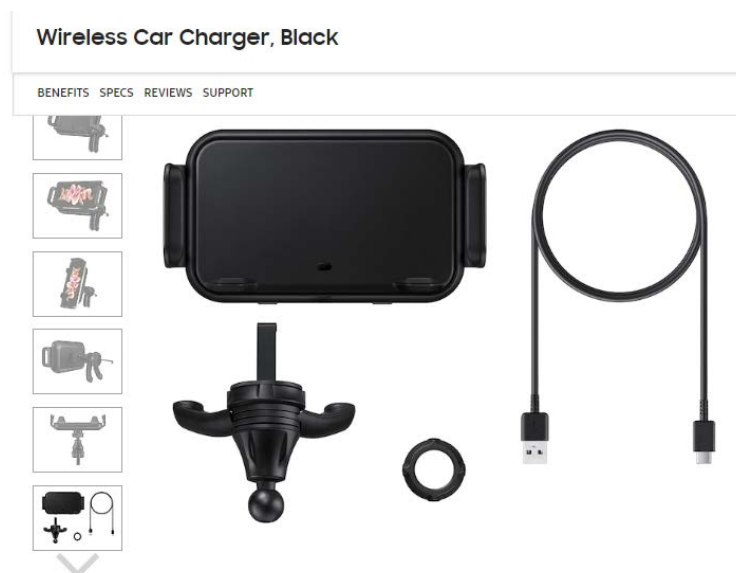
<https://www.samsung.com/us/mobile/mobile-accessories/phones/15w-wireless-charger-Duo-Pad-cable-dark-gray-ep-p5400cbegus/>



[Wireless Charger Trio Pad, Black Mobile Accessories - EP-P6300TBEGUS | Samsung US](https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-car-charger-black-ep-h5300cbegus/)



<https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-car-charger-black-ep-h5300cbegus/>



The representative 3300 Wireless Charger Battery includes an internal power supply such as a PMIC and/or Boost Regulator to provide the needed DC voltage coupled by the switching circuits to the wireless charging coils for passing a current through the coils. When not plugged in, the 3300 Wireless Charger Battery uses its internal battery as the source of power for the internal power supply, and when the 3300 Wireless Charger Battery is plugged in, an external power supply such as an AC/DC USB wall power adapter and/or the internal battery is used as the source of power for the internal power supply.

a communications interface that the base unit, and the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, use to communicate with one another during powering or charging, to

The 208 Accused Products meet this part of the claim, as they each have sense circuitry and microcontrollers for communication via current modulation on their charging coils with the receiver when being wirelessly powered/charged, as specified by this part of the claim.

Representative of the 208 Accused Products, the 930 Stand, 5200 Duo Pad, 5400 Duo Pad, 6300 Trio Pad, and 5300 Car Phone Mount chargers and the 3300 Wireless Charger Battery meet this part of the claim by way of an included communication interface (comprising for example an included wireless power ASIC and associated circuitry) to communicate by way of current modulation through the charging coil during wireless power transfer. For example, these products do so to be interoperable with the Wireless Power Consortium (WPC) standard (aka Qi standard) (“WPC Standard”) and/or Samsung’s wireless charging protocols.

Wireless chargers

The representative 930 Stand, 5200 Duo Pad, 5400 Duo Pad, 6300 Trio Pad, and 5300 Car Phone Mount chargers and 3300 Wireless Charger Battery are compatible with the WPC Standard and receive communication from the receiver for inductive power transfer per the WPC Standard.

<https://www.tigerdirect.com/applications/SearchTools/item-details.asp?EdpNo=2423193>



Compatibility

The wireless Fast Charge feature is compatible with Galaxy Note5, Galaxy S6 edge+ and later models of the Galaxy Note and Galaxy S series. Wireless Fast Charge is not compatible with Galaxy S6, Galaxy S6 edge or Galaxy S6 active. Those devices will charge at regular speed. Universal wireless charging support for all Qi-enabled devices. Charging your device wirelessly may require the addition of a wireless charging cover (sold separately).

<https://www.wirelesspowerconsortium.com/products/1542>

SAMSUNG WIRELESS CHARGER STAND (EP-NG930)



BRAND
SAMSUNG

PRODUCT NAME
Wireless Charger Stand

MANUFACTURER PART NUMBER
EP-NG930

PRODUCT TYPE
Power Class 0 Transmitter

REGISTRATION DATE
February 20, 2016



ADDITIONAL DETAILS

Qi Registration id	1542
Version	1.2.1
Currently licensed	Yes
Power profile	Basic Power Profile
Transmitter design	A28
Automotive Charger for inline assembly	No
Compliant Automotive Guidelines	No
Evaluation module	No
Potential power level	5 watts
Subsystem for integration in other products	No

<https://www.samsung.com/us/mobile/mobile-accessories/phones/wireless-charger-Duo-Pad-pad-black-ep-p5200tbegus/>



Qi certified

The Wireless Charger Duo Pad is Qi certified meaning any Qi compatible products can charge on it, including the Samsung Galaxy S10, Galaxy Note9, Apple iPhone 8, iPhone X, and Google Pixel 3.

<https://www.wirelesspowerconsortium.com/products/5489>

SAMSUNG ELECTRONICS WIRELESS CHARGER (EP-P5200)

**BRAND**

Samsung Electronics

PRODUCT NAME

Wireless Charger

MANUFACTURER PART NUMBER

EP-P5200

PRODUCT TYPE

Power Class 0 Transmitter

REGISTRATION DATE

March 4, 2019

**ADDITIONAL DETAILS**

Qi Registration id	5489
Version	1.2.4
Currently licensed	Yes
Power profile	Basic Power Profile
Transmitter design	A11a
Automotive Charger for inline assembly	No
Compliant Automotive Guidelines	No
Evaluation module	No
Potential power level	5 watts
Subsystem for integration in other products	No

Do you have a comment or complaint about this product?

Tell us

https://www.amazon.com/gp/product/B09MV3BRHC/ref=ask_ql_qh_dp_hza?th=1



This item Samsung 15W Wireless Charger Duo (w/TA), Black

Add to Cart

Customer Rating	★★★★☆ (40)
Price	\$78 ²⁸
Shipping	FREE Shipping. Details
Sold By	Amazon.com
Color	Black
Compatible Phone Models	Samsung Galaxy S10, Apple iPhone X, Samsung Galaxy Note 10

Wireless Charger Trio Pad, White Mobile Accessories - EP-P6300TWEGUS | Samsung US

The incredible 3-in-1 charger

With room to hold three devices at once — a smartwatch and two phones, or a smartwatch, earbuds, and phone — you can power up your ecosystem all at once. So when you're done for the day, just put your devices down in one place to be ready for tomorrow.



Compatible Models

Fast Charge compatible with Galaxy Note20, Note20 ultra, S20, S20+, S20 ultra, Z Fold2, Z Flip, Note 10+, Note 10, S10e, S10, S10+, S10 5G, Note9, S9, S9+, Note8, S8, S8+, S7, S7 Edge, Note 5, S6 Edge+ & Apple iPhone 11 pro, 11, SE, XS Max, XS, XR, 8, 8 Plus / Qi compatible with Galaxy S6, S6 Edge and Qi certified devices (Galaxy Buds live, Buds+) / Galaxy Watch3, Watch Active2, Watch Active

<https://www.wirelesspowerconsortium.com/products/11748>

SAMSUNG WIRELESS CAR CHARGER (EP-H5300)



BRAND
Samsung

PRODUCT NAME
Wireless Car Charger

MANUFACTURER PART NUMBER
EP-H5300

PRODUCT TYPE
Power Class 0 Transmitter

REGISTRATION DATE
October 12, 2021

ADDITIONAL DETAILS

Qi Registration id	11748
Version	1.2.4
Currently licensed	Yes
Power profile	Basic Power Profile
Transmitter design	A36
Automotive Charger for inline assembly	No
Compliant Automotive Guidelines	No
Evaluation module	No
Potential power level	5 watts
Subsystem for integration in other products	No
Samsung Proprietary Extension	Yes



<https://www.samsung.com/us/mobile/mobile-accessories/phones/25w-wireless-portable-battery--silver-eb-u3300xjegus/>

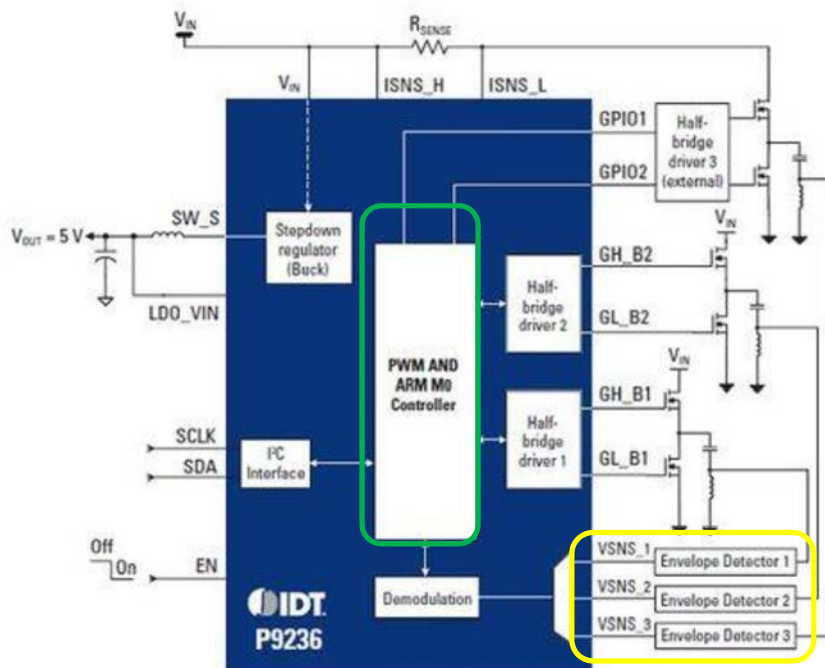
Power up your devices all at once

With both a wireless pad and two wired charging ports, you can charge up to three devices in one go. It supports a variety of protocols to be able to charge your Qi-certified phone, Galaxy Watch, and earbuds.

The representative 930 Stand, 5200 Duo Pad, 5400 Duo Pad, and 6300 Trio Pad chargers and 3300 Wireless Charger Battery include IDT/Renesas IDT P9236 transmitter ASICs (or the like) for wireless power transfer.

As shown below, the IDT P9236 ASIC includes a demodulator (yellow rectangle) and microcontroller (green rectangle). The demodulator senses current modulation in the charger coil to detect a communication from the receiver being charged and to also sense the presence or absence of the receiver. The microcontroller in the ASIC controls the operation of the charger system.

https://archive.eetindia.co.in/www.eetindia.co.in/ART_8800706913_1800008_NP_7a10c6fc.HTM



WPC Illustrations

That the 208 Accused Products meet this part of the claim is also reflected in the WPC Standard with which these products are interoperable.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 86 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 139; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 86).

5.2 Power Receiver to Power Transmitter communications interface

5.2.1 Introduction

The Power Receiver communicates to the Power Transmitter using backscatter modulation. For this purpose, the Power Receiver modulates the amount of power that it draws from the Power Signal. The Power Transmitter detects this as a modulation of the current through and/or voltage across the Primary Cell. In other words, the Power Receiver and Power Transmitter use an amplitude modulated Power Signal to provide a Power Receiver to Power Transmitter communications channel.

5.2.2 Physical and data link layers (PRx to PTx)

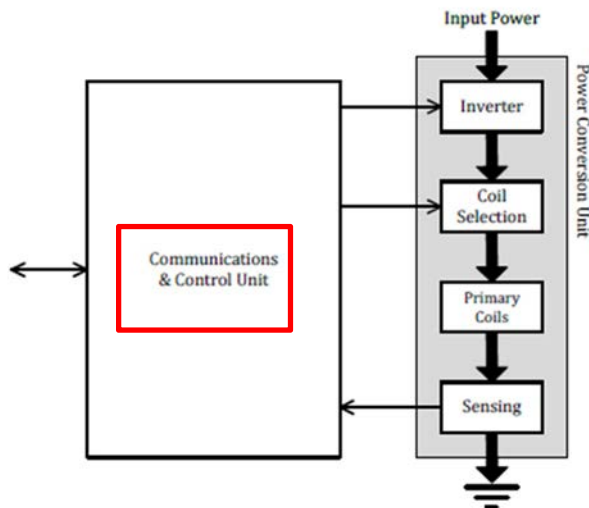
This section defines both the physical layer and the data link layer of the Power Receiver to Power Transmitter communications interface.

5.2.2.1 Modulation scheme

The Power Receiver shall modulate the amount of power that it draws from the Power Signal, such that the Primary Cell current and/or Primary Cell voltage assume two states, namely a HI state and a LO state.⁸ A state is characterized in that the amplitude is constant within a certain variation Δ for at least t_s ms. If the Power Receiver is properly aligned to the Primary Cell of a type A10 or MP-A1 Power Transmitter, and for all appropriate loads, at least one of the following three conditions shall apply:⁹

This is also reflected in the WPC Reference Designs. E.g., WPC 1.2.4 Standard, Part 4, Reference Designs, page 31.

Figure 10. Functional block diagram of Power Transmitter design A4



The Communications and Control Unit on the left-hand side of Figure 10 comprises the digital logic part of the design. The Communications and Control Unit receives and decodes messages from the Power Receiver, configures the Coil Selection block to connect the appropriate Primary Coil, executes the relevant power control algorithms and protocols, and drives the input voltage of the AC waveform to control the power transfer. The Communications and Control Unit also interfaces with other subsystems of the Base Station, e.g. for user interface purposes.

poll each of the primary coils, or receive a signal from a sensor associated therewith, to verify the presence of the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device placed upon or close to the surface of the base unit,

The 208 Accused Products meet this part of the claim, as they each poll their charging coils to verify the presence of a receiver to wirelessly charge, as specified by this part of the claim per the WPC Standard, illustrated below.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 46 (see also WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 124; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 46):

- *ping* In this phase, the Power Transmitter executes a Digital Ping, and listens for a Response. If the Power Transmitter discovers a Power Receiver, the Power Transmitter may extend the Digital Ping, i.e. maintain the Power Signal at the level of the Digital Ping. This causes the system to proceed to the identification & configuration phase. If the Power Transmitter does not extend the Digital Ping, the system shall revert to the selection phase.

As shown below, the charger system polls (i.e. pings) each of the primary coils to detect the start of a communication from the receiver. If no such response is received the charger systems stops applying power to that coil and returns to pinging periodically until a receiver is found. If a valid

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communication is received, the charger system may extend the ping and proceed to Identification and Configuration phase.



5.1.2.2 Ping phase (PTx perspective)

In the *ping* phase, the Power Transmitter shall execute a Digital Ping. This Digital Ping shall proceed as follows, with conditions appearing earlier in this list taking precedence over conditions appearing later.

- The Power Transmitter shall apply a Power Signal at the Operating Point defined for the particular Power Transmitter design (see Part 4: Reference Designs).
- If the Power Transmitter does not detect the start of a Packet in the time window t_{ping} after the Primary Cell current amplitude reaches 50% of the stable level, the Power Transmitter shall remove the Power Signal (i.e. reduce the Primary Cell current to zero) within $t_{\text{terminate}}$. See Figure 19(a).
- If the Power Transmitter correctly receives a Signal Strength Packet, the Power Transmitter may proceed to the *identification & configuration* phase of the power transfer, maintaining the Power Signal at the Operating Point as defined for the particular Power Transmitter design. See Figure 19(b). If the Power Transmitter does not proceed to the *identification & configuration* phase, the Power Transmitter shall remove the Power Signal within t_{expire} after the start of the Signal Strength Packet. See Figure 19(c).

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 152 (see also WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 157; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 150):

B.2 Primary Coil array based Free Positioning

In the case of Free Positioning, discovery and localization of a Power Receiver is less straightforward. This Annex B.2 discusses one sample approach, which is particularly suited to a Primary Coil array-based Power Transmitter. In this approach, the Power Transmitter first discovers and locates the objects that are present on its Interface Surface (e.g. using any of the methods discussed in Section 10, *Object Detection (Informative)*). This results in a set of Primary Cells, which represents the locations of potential Power Receivers. For each of the Primary Cells in this set, the Power Transmitter executes a Digital Ping (see Section 5.1.2.2), removing the Power Signal after receipt of a Signal Strength Packet (or an End Power Transfer Packet, or after a time out).¹⁴ This yields a new set of Primary Cells, namely those that report a Signal Strength Value above a certain threshold—which the Power Transmitter chooses. Finally, the Power Transmitter executes an extended Digital Ping (see Sections 5.1.2.2 and 5.1.2.3) for each of the Primary Cells in this new set in order to identify the discovered Power Receivers. The Power Transmitter should take the situations discussed in Annex B.2.1, B.2.2, and B.2.3 into account in order to select the most appropriate Primary Cells from the set for power transfer.

select, based on the polling or sensing, from within the plurality of primary coils, and selectively switch, using their associated switching circuits to activate, only those one or more primary coils

which are determined to be most closely aligned with a receiver coil at the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, and

The 208 Accused Products meet this part of the claim, as they each, based on the polling, select the charger coil most closely aligned with a receiver coil for wireless charging of the receiver, as specified by this part of the claim per the WPC Standard, illustrated below.

Pursuant to the WPC standard, the 208 Accused Products apply power to each coil sequentially for a period of time to see if they detect a message from a potential nearby and aligned receiver. The first information sent by a receiver is a Signal Strength Packet indicating that the receiver has received sufficient power to activate its internal circuitry and a value corresponding to a degree of coupling (i.e. alignment and gap) between the receiver and charger system coil that performed the ping. This information is used by the charger to determine the charger coil most closely aligned with a receiver coil. E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface

5.2.3 Logical layer (PRx to PTx)

This section defines the format of the messages used by the Power Receiver to Power Transmitter communications interface.

5.2.3.1 Signal Strength Packet (0x01)

Table 27 defines the format of the message contained in a Signal Strength Packet.

Table 27. Signal strength

	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀
B ₀	Signal Strength Value							

Signal Strength Value. The unsigned integer value in this field indicates the degree of coupling between the Primary Cell and Secondary Coil, with the purpose to enable Power Transmitters that use Free Positioning to determine the Primary Cell that provides optimum power transfer (*see also* Annex B, *Power Receiver Localization (Informative)*). To determine the degree of coupling, the Power Receiver shall monitor the value of a suitable variable during a Digital Ping. Examples of such variables are:

- The rectified voltage.
- The open circuit voltage (as measured at the output disconnect switch).
- The received Power (if the rectified voltage is actively or passively clamped during a Digital Ping).

The variable that is chosen shall result in a Signal Strength Value that increases monotonically with an increasing degree of coupling. The Signal Strength Value is reported as

$$\text{Signal Strength Value} = \frac{U}{U_{\max}} \cdot 256,$$

where U is the monitored variable and $U_{\max}$ is the maximum value that the Power Receiver expects during a Digital Ping.

NOTE The Power Receiver shall set the Signal Strength Value to 255 in the case that $U \geq U_{\max}$.

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E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 152 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 157; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 150):

Power Receivers. For each of the Primary Cells in this set, the Power Transmitter executes a Digital Ping (see Section 5.1.2.2), removing the Power Signal after receipt of a Signal Strength Packet (or an End Power Transfer Packet, or after a time out).¹⁴ This yields a new set of Primary Cells, namely those that report a Signal Strength Value above a certain threshold—which the Power Transmitter chooses. Finally, the Power Transmitter executes an extended Digital Ping (see Sections 5.1.2.2 and 5.1.2.3) for each of the Primary Cells in this new set in order to identify the discovered Power Receivers. The Power Transmitter should take the situations discussed in Annex B.2.1, B.2.2, and B.2.3 into account in order to select the most appropriate Primary Cells from the set for power transfer.

The effect of alignment and coupling between the transmitter coil and receiver coil is discussed below *E.g.*, WPC 1.2.4 Standard, Parts 1 and 2, Introduction, page 9 and page 12.



the electronics of an appropriate load to which it is connected. Conventional transformers use the same effect to achieve inductive power transfer between a primary and a secondary coil that are strongly coupled by means of a magnetic core.

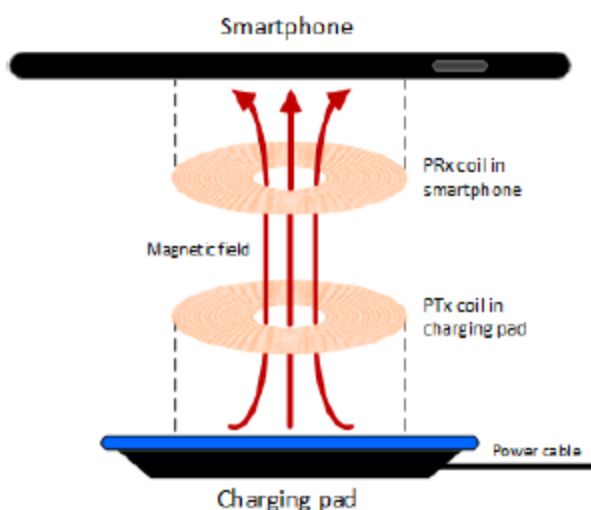
Although a Qi-based system is similar to a conventional transformer in the sense that power is transferred from a first coil to a second coil, it is also very different because of the much lower **magnetic coupling** between those coils. A conventional transformer has a **magnetic coupling coefficient** close to one, whereas a Qi-based system typically has a magnetic **coupling coefficient** in the range of 0.5 or below.

In the Qi-based system illustrated in Figure 4, power is transferred from the PTx contained in the Qi charging pad to a PRx contained in the Qi smartphone. Before charging begins, the PRx and PTx communicate with each other to establish that the mobile device is indeed capable of being charged, whether it needs to be charged, how much power is required, etc. In short, the communication ensures an appropriate power transfer from the power transmitter to the power receiver. The communication channel can also be used to trigger location based services by providing an SSID, a Bluetooth link, or a unique ID.

When charging begins, the power transmitter runs an alternating electrical current through its coil(s), which generates an alternating magnetic field in accordance with Faraday's law. This magnetic field is in turn picked up by the coil inside the power receiver and transformed by a power converter back into an alternating electrical current that can be used to charge the battery.

A critical feature of the magnetic field is that it can transfer through any non-metallic, non-ferrous materials, such as plastics, glass, water, wood, and air. In other words, wires and connectors are not needed between the power transmitter and power receiver.

Figure 6. Qi wireless power transfer using magnetic induction



4.4 Coupling requirements

Coupling occurs when current changes in one coil creates a voltage in the other coil via magnetic induction.

Coupling is highest—with the most efficient power transfer—when:

- the PTx and PRx use exactly the same coil
- the PTx and PRx are perfectly aligned
- the distance between the coils is small (less than the diameter of the coils)
- the coils are externally shielded by ferrite

Conditions that decrease coupling (and power transfer efficiency) include different power transmitter/power receiver coil sizes and shapes, coil misalignment, excessive distance between coils, and the presence of foreign objects on the power transmitter.

periodically thereafter exchange information to provide power transfer to the device and/or battery, including device and/or battery charging or power status or presence; and

The 208 Accused Products meet this part of the claim as they each periodically receive information from the receiver to provide wireless power transfer as claimed, per the WPC Standard, illustrated below. Pursuant to the WPC standard, the 208 Accused Products communicate with any WPC receiver present using the communication and control protocol outlined in the WPC Standard, which includes receiving control data sent by the WPC receiver including the receiver's charging status and presence.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 50 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 124; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 49):

6. *Power transfer phase.* Section 5.1.2.6 defines the part of the protocol that the Power Transmitter shall execute during power transfer. In this part of the protocol, the Power Transmitter controls its Primary Cell current in response to control data received from the Power Receiver.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 64 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 130; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 63):

5.1.2.6 Power transfer phase (PTx perspective)

In the *power transfer* phase, the Power Transmitter controls the power transfer to the Power Receiver, in response to control data that it receives from the latter. For this purpose, the Power Transmitter shall receive zero or more of the following Packets:

- Control Error Packet.
- Received Power Packet.
- Charge Status Packet.
- End Power Transfer Packet.
- Renegotiate Packet.
- Any Proprietary Packet (as listed in Table 26). If the Power Transmitter does not know how to handle the message contained in the Proprietary Packet, the Power Transmitter shall ignore that message.
- Any reserved Packet (as indicated in Table 26). The Power Transmitter shall ignore the message contained in the reserved Packet.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 46 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 124; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 46):

Throughout the *power transfer* phase, the Power Transmitter and Power Receiver control the amount of power that is transferred. Figure 17 illustrates a schematic diagram of the power transfer control loop, which basically operates as follows: the Power Receiver selects a desired Control Point: a desired output current and/or voltage, a temperature measured somewhere in the Mobile Device, etc. In addition, the Power Receiver determines its actual Control Point. The Power Receiver may use any approach to determine a Control Point. Moreover, the Power Receiver may change this approach at any time during the *power transfer* phase. Using the desired Control Point and actual Control Point, the Power Receiver calculates a Control Error Value—for example, by simply taking the (relative) difference of the two output voltages or currents. The result is negative if the Power Receiver requires less power in order to reach its desired Control Point and positive if the Power Receiver requires more power in order to reach its desired Control Point. Subsequently, the Power Receiver transmits this Control Error Value to the Power Transmitter.

wherein the substantially perpendicular magnetic field is used to inductively generate a current in the receiver coil within or on the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device placed upon the activated primary coil of the base unit, to charge or power the device and/or battery, and

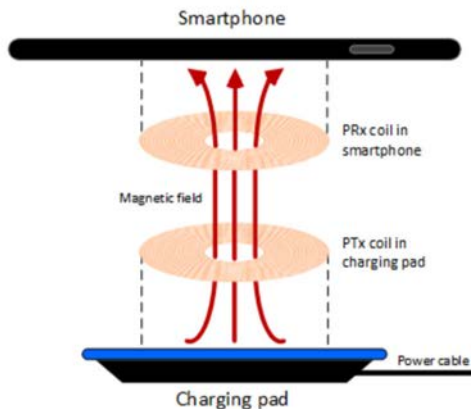
The 208 Accused Products meet this part of the claim, as they each induce magnetic fields perpendicular to their charging coils to induce voltage/current in the receiver coil to power or charge the receiver, as illustrated below.

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E.g., WPC 1.2.4 Standard, Introduction, page 9:

When charging begins, the power transmitter runs an alternating electrical current through its coil(s), which generates an alternating magnetic field in accordance with Faraday's law. This magnetic field is in turn picked up by the coil inside the power receiver and transformed by a power converter back into an alternating electrical current that can be used to charge the battery.

A critical feature of the magnetic field is that it can transfer through any non-metallic, non-ferrous materials, such as plastics, glass, water, wood, and air. In other words, wires and connectors are not needed between the power transmitter and power receiver.

Figure 6. Qi wireless power transfer using magnetic induction



wherein the base unit, and receiver coil or circuitry associated therewith, use current modulation performed by the receiver coil or its circuitry, to provide an indication that is then used by the base unit to

The 208 Accused Products meet this part of the claim as they each receive information from the receiver by way of current modulation in the charging coils, per the WPC Standard, illustrated below.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 87 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 139; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 86):

5.2 Power Receiver to Power Transmitter communications interface

5.2.1 Introduction

The Power Receiver communicates to the Power Transmitter using backscatter modulation. For this purpose, the Power Receiver modulates the amount of power that it draws from the Power Signal. The Power Transmitter detects this as a modulation of the current through and/or voltage across the Primary Cell. In other words, the Power Receiver and Power Transmitter use an amplitude modulated Power Signal to provide a Power Receiver to Power Transmitter communications channel.

5.2.2.1 Modulation scheme

The Power Receiver shall modulate the amount of power that it draws from the Power Signal, such that the Primary Cell current and/or Primary Cell voltage assume two states, namely a HI state and a LO state.⁸ A state is characterized in that the amplitude is constant within a certain variation Δ for at least t_s ms. If the Power Receiver is properly aligned to the Primary Cell of a type A10 or MP-A1 Power Transmitter, and for all appropriate loads, at least one of the following three conditions shall apply:⁹

- The difference of the amplitude of the Primary Cell current in the HI and LO state is at least 15 mA.
- The difference of the Primary Cell current in the HI and LO state is at least 15 mA. The Primary Cell current is measured at instants in time that correspond to one quarter of the cycle of the control signal driving the half-bridge inverter.¹⁰
- The difference of the amplitude of the Primary Cell voltage in the HI and LO state is at least 200 mV.

determine and regulate one or more of output voltage, current, or power provided by the base unit to the device and/or battery to be within the range of one or more of a value of a required voltage, current, or other power parameter for the mobile, electronic, or other device and/or battery, battery door, or skin for use with the device, and/or

The 208 Accused Products meet this part of the claim as they each perform closed loop feedback control of the voltage or current induced at the receiver, per the WPC Standard, illustrated below.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 46 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 124; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 46):

Throughout the *power transfer* phase, the Power Transmitter and Power Receiver control the amount of power that is transferred. Figure 17 illustrates a schematic diagram of the power transfer control loop, which basically operates as follows: the Power Receiver selects a desired Control Point: a desired output current and/or voltage, a temperature measured somewhere in the Mobile Device, etc. In addition, the Power Receiver determines its actual Control Point. The Power Receiver may use any approach to determine a Control Point. Moreover, the Power Receiver may change this approach at any time during the *power transfer* phase. Using the desired Control Point and actual Control Point, the Power Receiver calculates a Control Error Value—for example, by simply taking the (relative) difference of the two output voltages or currents. The result is negative if the Power Receiver requires less power in order to reach its desired Control Point and positive if the Power Receiver requires more power in order to reach its desired Control Point. Subsequently, the Power Receiver transmits this Control Error Value to the Power Transmitter.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 64 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 130; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 63):

5.1.2.6 Power transfer phase (PTx perspective)

In the *power transfer* phase, the Power Transmitter controls the power transfer to the Power Receiver, in response to control data that it receives from the latter. For this purpose, the Power Transmitter shall receive zero or more of the following Packets:

- Control Error Packet.
- Received Power Packet.
- Charge Status Packet.
- End Power Transfer Packet.
- Renegotiate Packet.
- Any Proprietary Packet (as listed in Table 26). If the Power Transmitter does not know how to handle the message contained in the Proprietary Packet, the Power Transmitter shall ignore that message.
- Any reserved Packet (as indicated in Table 26). The Power Transmitter shall ignore the message contained in the reserved Packet.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 50 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 126; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, pages 49, 70):

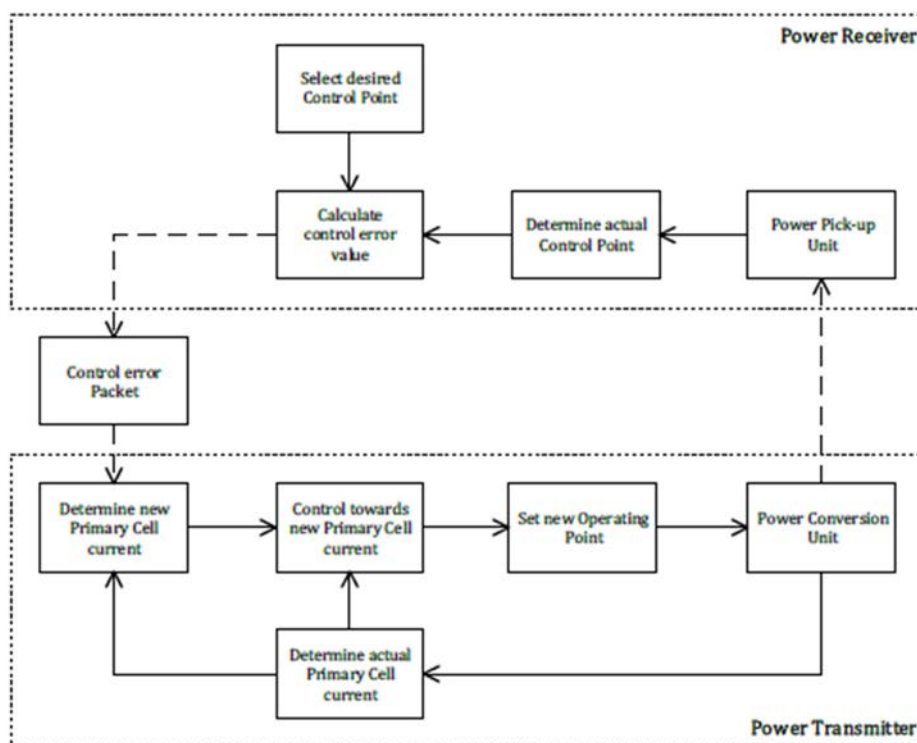
6. *Power transfer* phase. Section 5.1.2.6 defines the part of the protocol that the Power Transmitter shall execute during power transfer. In this part of the protocol, the Power Transmitter controls its Primary Cell current in response to control data received from the Power Receiver.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, pages 46-47 (*see also* WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 124-125; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 46-47):

- *power transfer* In this phase, the Power Transmitter continues to provide power to the Power Receiver, adjusting its Primary Cell current in response to control data that it receives from the Power Receiver. Throughout this phase, the Power Transmitter monitors the parameters that are contained in the Power Transfer Contract. A violation of any of the stated limits on any of those parameters causes the Power Transmitter to abort the power transfer, and returns the system to the *selection* phase. Finally, the system may also leave the *power transfer* phase on request of the Power Receiver. Section 5.1.2 defines the system control protocols in the *ping*, *identification & configuration*, and *power transfer* phases from a Power Transmitter perspective. Section 5.1.3 defines the system control protocols in these four phases from a Power Receiver perspective.

The Power Transmitter uses the Control Error Value and the actual Primary Cell current to determine a new Primary Cell current. After the system stabilizes from the communications of the Control Error Packet, the Power Transmitter has a short time window to control its actual Primary Cell current towards the new Primary Cell current. Within this window, the Power Transmitter reaches a new Operating Point: the amplitude, frequency, and duty cycle of the AC voltage that is applied to the Primary Cell. Subsequently, the Power Transmitter keeps its Operating Point fixed in order to enable the Power Receiver to communicate additional control and status information. For details, see Section 5.1.2.6.1, *Power transfer control*.

Figure 17. Power transfer control loop



verify the continued presence of the receiver coil near the base unit.

The 208 Accused Products meet this part of the claim as during wireless power transfer they each monitor for the continued presence of the receiver, per the WPC Standard, illustrated below.

E.g., WPC 1.2.4 Standard, Parts 1 and 2, Interface Definitions, page 46 (see also WPC 1.1.2 Standard, Parts 1 and 2, Interface Definitions, page 124; WPC 1.2.3 Standard, Parts 1 and 2, Interface Definitions, page 46):

At any time, a user can remove a Mobile Device that is receiving power. The Power Transmitter can recognize such an event from a time-out in the communications from the Power Receiver, or from a violation of the Power Transfer Contract. As a result, the Power Transmitter aborts the power transfer and the system reverts to the *selection* phase.